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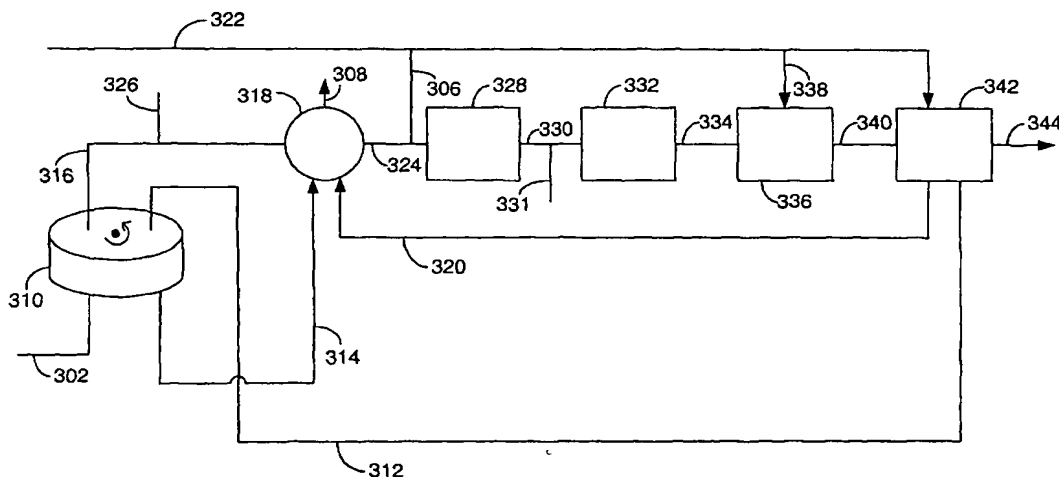
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[Continued on next page]

(54) Title: HYDROGEN GENERATOR HAVING SULFUR COMPOUND REMOVAL AND PROCESSES FOR THE SAME



(57) Abstract: Apparatus and processes for the generation of hydrogen from hydrocarbon feeds are provided in which organosulfur compound is removed from the feed. The apparatus and processes are particularly advantageous as smaller scale hydrogen generators including those generators intended for residential use to produce hydrogen for fuel cells to produce electricity. In the processes and apparatus, the feed is contacted with solid sorbent to remove organosulfur compound.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/31858

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C10G25/00 B01D53/86 C10L3/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C10G B01D C10L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 168 768 B1 (TAYLOR JR JAMES H ET AL) 2 January 2001 (2001-01-02) column 6, line 39 - column 7, line 34	1,6,10
A	EP 1 236 495 A (ENGELHARD CORP) 4 September 2002 (2002-09-04) claims 1,2,6,8,10,22 paragraph '0043! - paragraph '0046!	1,3,6, 10,11
X	EP 0 421 500 A (METALLGESELLSCHAFT AG) 10 April 1991 (1991-04-10)	13
A	claim 1 figure 1	15,16,18
A	DE 43 21 542 C (BFI ENTSORGUNGSTECH) 1 September 1994 (1994-09-01) claims 1,8	15,16

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

international application No.
PCT/US 03/31858

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/ US 03 /31858

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-12

A process and an apparatus for generating hydrogen from a hydrocarbon feed containing organosulfur compounds. Sulfur compounds are removed from the feedstock by contacting the feedstock with a bed of solid sorbent. The sorption effluent is steam reformed to a hydrogen containing stream.

The sorbent is regenerated by using a regeneration gas consisting of a combustion fuel and an oxygen containing gas during which an organosulfur containing purge is formed and using this purge in a combustion step to provide heat for use within the process and to convert the organosulfur compound to sulfur dioxide.

2. claims: 13-20

Combination process and apparatus for removing of sulfur compounds (organosulfur compounds and CXS (X being O or S)) from a hydrocarbon feedstock.

The combination process consists of a CXS hydrolysis step in which hydrogensulfide and carbon dioxide are formed, and one or two sulfur adsorption steps.

One adsorption steps removes CXYS, the other one adsorbs hydrogen sulfide.

INTERNATIONAL SEARCH REPORT

Information on patent family members

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